

# Benefits associated with supplier integration into new product development under conditions of technology uncertainty

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## Abstract

In many industries, firms are striving to integrate material suppliers earlier into the new product/process development process. This involvement may range from simple consultation with suppliers on design ideas to making suppliers fully responsible for the design of components or systems they will supply. In this paper, we develop and test a conceptual model of the effect of elements of the supplier integration process on cost, quality, and new product development time, under conditions of technology uncertainty. Technology uncertainty is operationalized here, as the degree to which the product or process technologies employed in the project are new, complex, and/or rapidly changing. The results suggest that technology uncertainty have a negative impact on cost results, but no direct effect on quality or cycle time. The results also show that certain elements of the supplier integration process are more likely to be employed under conditions of technology uncertainty, leading to significant improvements in cost, quality, and cycle time objectives. © 2001 Elsevier Science Inc. All rights reserved.

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## 1. Introduction

Firms in many industries face increasing global competition and markets that demand more frequent innovation and higher quality. These firms are looking for ways to decrease product development time and simultaneously, improve quality and features, and significantly reduce product (or service) cost. One approach many companies are taking to gain competitive advantage is to involve suppliers earlier in the design and development process (Ragatz et al., 1997). Supplier involvement may range from simple consultation on design ideas to making suppliers fully responsible for the design of components, systems, processes, or services they will supply. The result is often a better product design that is brought to market faster and ultimately, delivers greater value for the customer.

Using the knowledge and expertise of suppliers to complement internal capabilities may help reduce concept-to-

customer cycle time, costs, quality problems, and improve the overall design effort. Reports in the popular press indicate that leading companies in a variety of industries have made successful efforts at involving suppliers in the new product development process, and that interest in such efforts is growing (see, for example, Raia, 1992, 1993a,b).

References to supplier integration into new product development typically examine the outputs of the process (Kamath and Liker, 1994; Brown and Eisenhardt, 1995). However, such research only rarely examines the actual dynamics and factors influencing the process of supplier integration, such as timing of supplier involvement, degree of supplier design responsibility, and frequency of buyer/supplier communication (Hartley et al., 1997). Findings regarding the impact of supplier integration in new product development are mixed. If managers are to employ this strategy and justify the considerable effort and costs required, the processes and potential benefits of this approach must be better understood.

Over the past 3 years, a research team from The Global Procurement and Supply Chain Benchmarking Initiative at Michigan State University (MSU) has been studying strate-

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gies and best practices for integrating suppliers into new product development efforts. An initial survey was conducted of the member companies of MSU's Global Procurement and Supply Chain Electronic Benchmarking Network (GEBN). That survey was followed by in-depth field interviews with 18 leading-edge companies. This paper describes the model that emerged from the field studies, and utilizes the survey data to test the effects of supplier integration on cost, quality, and new product cycle time, with a set of structural equation models. Before introducing the model, we will provide a brief review of the literature on supplier integration into new product development.

## 2. Literature review

An increasing body of literature has identified new product development as a core process that is instrumental for success in the new global economy (Clark and Wheelwright, 1992; Clark and Fujimoto, 1991; Brown and Eisenhardt, 1995; Fiol, 1996). Some of the benefits that accrue to organizations that can master the creative processes required in bringing new products to market include speed, improved quality, lower cost, improved market share, competitive advantage, and greater intellectual capital (Glynn, 1996; Kessler and Chakrabarti, 1996). Academic researchers in several fields have produced a large number of studies, proposing an array of different variables deemed critical to successful new product development. Recent literature reviews (Brown and Eisenhardt, 1995) identify some of the more critical classes of variables. These variables include:

- team composition, organization, and processes (Katz and Allen, 1982; Ancona and Caldwell, 1990; Clark and Fujimoto, 1991);
- project leadership and senior management support (Imai et al., 1984; Dougherty, 1992);
- product effectiveness (Cooper and Kleinschmidt, 1987; Handfield, 1994; Zirger and Maidique, 1990);
- market issues (Meyers and Marquis, 1969; Rothwell et al., 1974); and
- customer/supplier integration (Clark and Fujimoto, 1991; Katz and Allen, 1982; Imai et al., 1984).

In the latter category, a great deal of effort has been spent showing how companies that incorporate a user's perspective in new product technology decisions have more successful products (Von Hippel, 1986; Cooper and Kleinschmidt, 1987; Rothwell et al., 1974; Rubenstein et al., 1976). However, the evidence supporting supplier integration is less clear. Some prior research has linked early (Gupta and Wilemon, 1990) and extensive (Clark and Fujimoto, 1991; Imai et al., 1984) supplier involvement with a faster development process. It is not clear, though, exactly how or when suppliers and customers should be involved in the develop-

ment process (Brown and Eisenhardt, 1995). Nor is the case for the benefits of supplier involvement unanimous. For instance, Eisenhardt and Tabrizi (1995) found that supplier involvement accelerated product development only in mature industry segments.

In addition to questions regarding the impact of supplier integration, the actual process of integrating suppliers into product development is still largely a "black box." While case studies and anecdotal evidence suggest that the participation of these outside constituents is probably important, the empirical literature is imprecise in the linkage between supplier integration and product/financial success (Atuahene-Gima, 1995). Although many of the internal processes associated with new product development are well understood and empirically supported, comparatively little information exists with respect to the elements of an effective process for integration of external suppliers into the new product development cycle. Clark and Fujimoto (1991), Brown and Eisenhardt (1995), Atuahene-Gima (1995), and Hartley et al. (1997) all recognize the need for more work in this area.

The lack of studies focusing on the supplier integration process does not diminish its importance. Monczka and Trent (1997) reported that procurement managers expect that over the next 5 years, competitive pressures will require manufacturers to reduce costs by 5–8% per year (after inflation) and continue to improve product quality, while simultaneously reducing time to market by 40–60%. In this competitive environment, suppliers are an increasingly important resource for manufacturers. Across all US manufacturers, purchased materials account for over 50% of the cost of goods sold. In addition, suppliers have a large and direct impact on cost, quality, technology, speed, and responsiveness of buying companies. Effective integration of suppliers into the product value/supply chain will be a key factor for some manufacturers in achieving the improvements necessary to remain competitive. Anecdotal reports of the value of supplier involvement in new product development have been supported by more scientific investigations as well. In a study of procurement and sourcing strategy changes and trends, Monczka and Trent (1997) found that US firms plan to rely increasingly on supplier design and technical capabilities to support new product design and development. The study also found that while 70% of the firms studied plan to emphasize formal early supplier design involvement in the future, almost 70% of those firms indicate that significant barriers are present that limit their ability to include suppliers. Major barriers include resistance on the part of either the buyer or supplier to sharing proprietary information relevant to the design, and a "not invented here" culture that makes buying company personnel reluctant to relinquish any responsibility in the new product development process.

Supplier integration involves a large number of variables that lead to success. Issues that arise with regard to

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